(12) UK Patent Application (19) GB (11) 2 221 181 (13) A

(43) Date of A publication 31.01.1990

(21) Application No 8902924.3

(22) Date of filing 09.02.1989

(30) Priority data
(31) 8803383 (32) 13.02.1988 (33) GB

(51) INT CL⁴
B26D 5/30

(52) UK CL (Edition J)
B4B B3C B3K
U1S S1789

(56) Documents cited
GB 1429860 A GB 1298181 A

(58) Field of search
UK CL (Edition J) B4B, B5D
INT CL⁴ B26D, B31D

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(54) Bag manufacture

(57) The apparatus enables bags to be made accurately from a continuous strip 12A of heat sealable material. A sensor 34 detects print registration marks on the strip 12A which is cut by a knife 14A. A transducer on nip rollers 16A provides pulses as the rollers turn to control means which after a predetermined count actuate the knife 14A. These pulses are also counted to determine the length between print registration marks detected by the sensor 34. This count is then used to determine a second value for the predetermined count for actuating the knife 14A to provide an accurate cut.

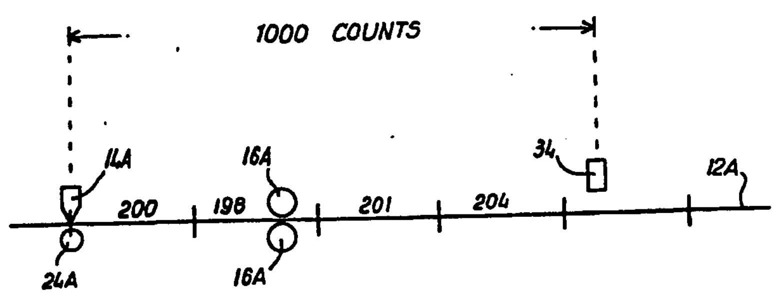

FIG. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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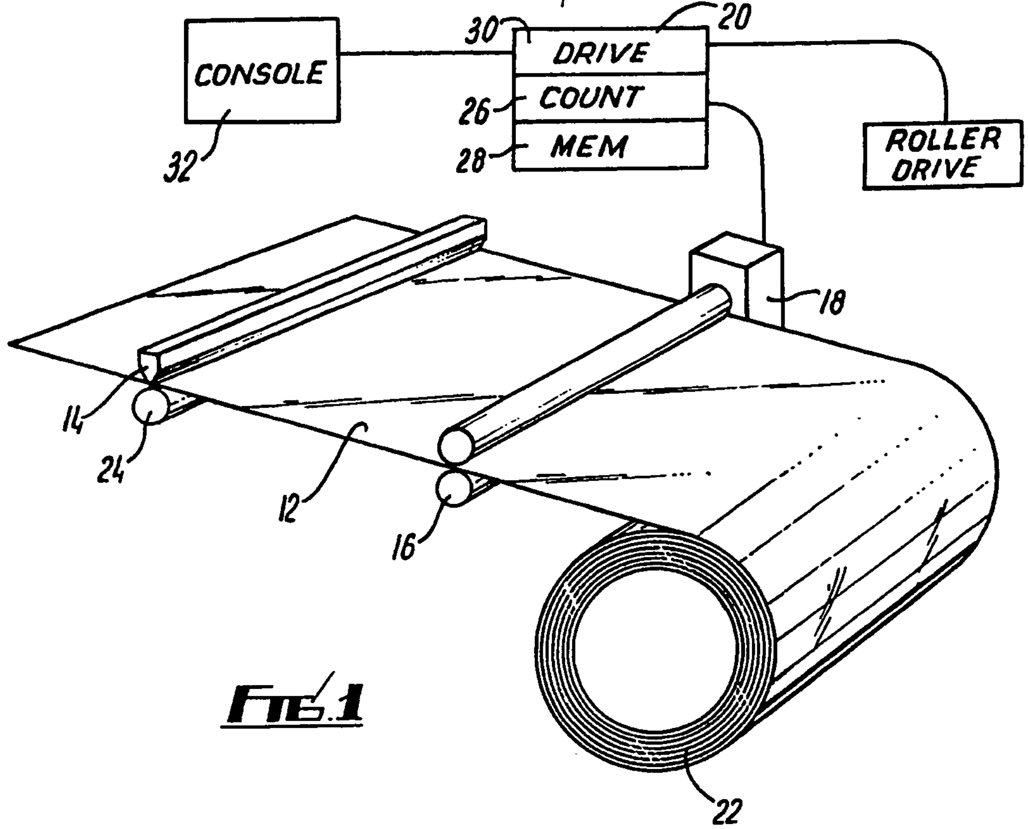

FIG.1

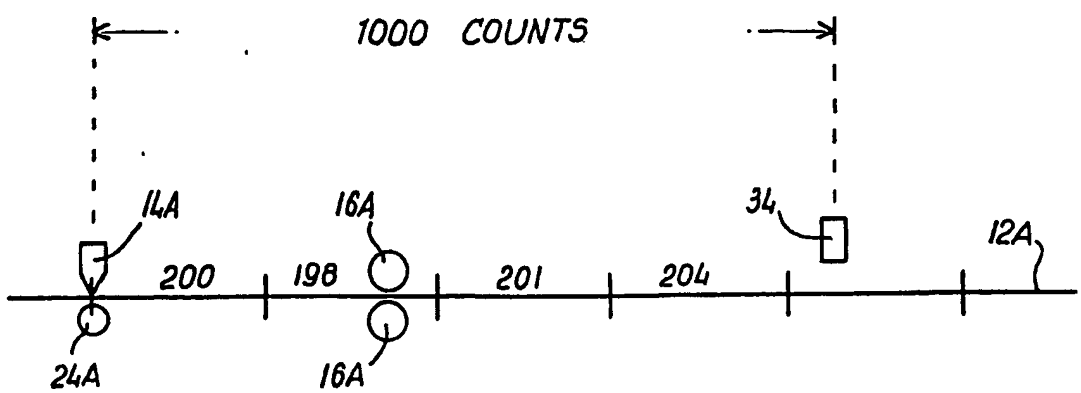

FIG.2

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Bag Manufacture

The present invention relates to bag manufacture and in particular to the production of bags from a continuous strip of heat sealable material such as a plastics material.

It is known to produce plastic bags from a strip of material by folding the strip lengthwise, cutting the strip off to length and sealing each cut by heat to form side seams of the bag. The fold forms the bottom of the bag. The mouth of the bag is formed by the edges of the original strip. Alternatively, a flattened tube of plastic sheet can be cut lengthwise before cutting it to length and sealing.

Known equipment uses nip rollers to feed the folded strip to a heated knife blade which cuts and seals in a single operation. Some of this equipment allows for the different bag sizes to be produced, by driving the nip rollers by a mechanically complex system including a variable speed motor or a variable gear mechanism, and operating a knife at regular intervals. The nip rollers run at different speeds for different bag sizes. The complexity gives the system a high degree of inertia, which restricts high speed running. The mechanisms are mechanically complex and consequently prone to failure.

They have also been found to present difficulties to fast and accurate changes of bag size.

Some inaccuracy and consequent variation in bag size can be tolerated when plain bags are being produced, but the production of printed bags requires much higher accuracy. Printed bags are formed from pre-printed strips of material which must be cut and seamed accurately, to avoid excessive wastage of bags formed with print at incorrect positions.

On some current machines, during setting up, a photo electric sensor is moved along the strip away from the knife until it is separated from the knife by a distance equal to the distance between print registration marks on the strip. The machine is set to draw a length up to 6 millimetres longer than the separation of the two print registration marks. When the machine is running, the sensor detects registration marks and controls the clutch and brake to override the final 6 millimetre of the draw. However, the pre-printed strip may have been printed under incorrect or varying tension thus creating stretched strip which affects the print position. If this is the case, the print register mark may not reach the sensor and adjustments must be made to increase the draw length to counter the error. The position of the

sensor must be adjusted regularly and equipment is normally built into machinery to allow this adjustment to be made. If the print registration mark moves off position, for any reason, or becomes obscure and unable to be picked up by the sensor the print position on successive bags will move in 6 mm steps. This will result in a large number of faulty bags, and will continue until enough 6mm steps have been made for the re-alignment of the print registration marks, or the operator has seen the error and stopped and reset the machine.

The present invention arises from an appreciation of these and other problems associated with the production of bags, and seeks to obviate or mitigate them.

According to the invention there is provided apparatus for making bags from a continuous strip of heat sealable material, the apparatus comprising cutting means operable to cut the material, heating means operable to form a seam in the material, feed means operable to feed the material past the cutting means, transducer means operatively connected to a member which rotates as the strip passes, to provide a signal each time the rotating member reaches a pre-selected orientation, control means

operable to count the said signals and to cause the material to be cut when a pre-determined count is reached, and the apparatus further comprises a sensor for detecting print registration marks on a pre-printed strip as aforesaid, the control means being operable to perform a second count of the number of signals produced by the transducer means as the strip is advanced from a position at which a print registration mark is detected to the position at which the next succeeding print registration mark is detected, and to set the value of the pre-determined count in accordance with the second count.

The control means may concurrently store a plurality of values of the pre-determined count for use in successive cutting operations.

Preferably the control means may store an expected value for the second count and may only respond to the sensor when the value of the second count is within a range of values which include the expected value. Preferably the control means is operable to stop the production of bags if no print registration mark has been detected after the second count has passed through the whole of the said range. The expected value may be manually set. Preferably, when the apparatus is being

prepared for use, the expected value is set as the value of the second count reached between the first two occasions on which a print registration mark is detected.

Preferably the drive to the feed means may be disconnected to allow the feed means to be operated by hand when the apparatus is being prepared for use.

Each value of the pre-determined count may be determined by adding the second count to the pre-determined count stored immediately previously. Alternatively, each value of the second count may be stored, the pre-determined count being zeroed at each cut. The first values for a pre-determined count may be set as the number of signals corresponding to the separation of the sensor and the cutting means, minus the number of signals corresponding to the separation of the first two print registration marks.

The invention also provides a method for making bags from a continuous strip of heat sealable material, in which cutting means are used to cut the material, heating means are used to form a seam in the material, feed means are used to feed the material past the cutting means, the orientation of a member which rotates as the strip passes is detected and used to generate a signal at

a pre-selected orientation, a count of the signals is made, and the material is cut when a pre-determined count has been reached, the method further including sensing print registration marks on a pre-printed strip as aforesaid, conducting a count of rotations of the rotating member as the strip is advanced from a position at which a print registration mark to the position at which the next succeeding print registration mark is detected, and setting the value of the predetermined count in accordance with the second count.

Preferably a plurality of values of the pre-determined count are concurrently recorded for use in successive cutting operations.

Preferably an expected value for the second count is recorded and no response is made to the output of the sensor except when the value of the second count is within a set range of values which include the expected value.

Preferably the production of bags is stopped if no print registration mark has been detected after the second count has past through the whole of the said range.

The expected value may be manually set.

When the apparatus is being prepared for use, the expected value is preferably set as the value of the second count reached between the first two occasions on which a print registration mark is detected. Preferably the drive to the feed means is disconnected when the apparatus is being prepared for use, and the rollers are turned under manual control.

Each value of the pre-determined count may be determined by adding the second count to the pre-determined count stored immediately previously. Alternatively, each value of the second count may be stored, the pre-determined count being zeroed at each cut. The first value of the pre-determined count is preferably set as the count corresponding to the separation of the sensor and the knife, minus the count corresponding to the separation of the first two print registration marks.

One example of an embodiment of the present invention will now be described in more detail, by way of example only and with reference to the accompanying drawings in which :

Fig. 1 is a simplified diagrammatic and part-

schematic perspective view of apparatus for making bags; and

Fig. 2 is a schematic side view of a version of the apparatus of Fig. 1 having additional facilities in accordance with the invention.

Fig. 1 shows apparatus 10 for making bags from a continuous strip 12 of heat sealable material such as polythene. The apparatus comprises a cutting knife 14 and a heater for heating the knife to cause the knife to form a seam in the strip 12. Upper and lower nip rollers 16 feed the material 12 past the knife 14. The apparatus 10 further comprises a transducer 18 which is a shaft encoder mounted on the lower nip roller 16 and which provides a signal each time the nip roller reaches any of a plurality of pre-selected orientations. A control device 10 based on a microprocessor counts signals from the transducer 18 and causes the knife 14 to operate when a pre-determined count has been reached.

In more detail, the apparatus comprises upper and lower nip rollers which feed the strip 12 from a roll 22 towards the knife 14. The knife 14 cuts by pressing down onto an anvil roller 24. The nip rollers are driven by a constant speed drive.

The transducer 18 is a shaft encoder which produces

electrical signals for the control device 20, as the lower nip roller 16 rotates. The shaft encoder 18 may produce a large number of electrical pulses during each revolution of the nip roller, so that the angular orientation of the nip roller can be accurately determined by the control device 20.

The control device 20 incorporates a counter section 26 which counts pulses from the shaft encoder 18. The device 20 also includes a memory 28, whose use will be explained below, and drive circuits 30 for controlling the knife and the nip roller drive. The device 20 also communicates with a console 32 for control purposes.

The shaft encoder 18 produces a pulse each time the nip rollers rotate through a known angle which depends on the structure of the encoder 18. Rotation of the rollers 16 through this angle causes a set length of the strip 12 to be fed to the knife 14, this length being determined by the radius of the nip roller 16 and the angle. A count of these pulses therefore corresponds to a measurement of the length of strip which has been fed.

In use, the console 32 is used to feed a value into the memory 28, the value being a pre-determined count which corresponds to the desired length of strip for

forming one bag. The value initially entered may be a coarse value, there being facility for fine adjustments to be made subsequently. The apparatus is then set to run, whereupon the nip rollers are driven to feed the strip 12 to the knife. The shaft encoder 18 pulses are counted until the pre-determined count stored in the memory is reached. The knife 14 is then operated and the count begins again. The use of a shaft encoder on the nip rollers allows bags to be cut accurately and repeatedly to size because the control device 20 can continuously monitor how much material has actually passed. A high production rate can therefore be obtained. The electronic nature of the control device 20 and the use of a mechanically simpler constant speed drive for the nip rollers mean that the apparatus can be expected to produce bags more reliably than prior proposed machinery.

If a different bag size is to be produced, a new value for the pre-determined count can be entered into the memory 28 through the console 32, and this can be done while the machine is running.

The apparatus described above can be expected to produce accurately cut bags even when using pre-printed strip 12. However, an alternative arrangement shown in

Fig. 2 has greater flexibility to cope with inaccurately printed pre-printed strip.

The apparatus shown in Fig. 2 has nip rollers 16A which feed pre-printed strip material 12A to the knife 14A and anvil roller 24A. The lower nip roller 16A is connected to a shaft encoder 18A. The elements so far described are the same as the correspondingly numbered elements in Fig. 1.

The apparatus of Fig. 2 additionally comprises a photo-electric sensor 34 located at a fixed distance from the knife 14A and at a position to detect print registration marks on the strip. Print registration marks are provided on the strip in conjunction with each printing of the bag design so that the cutting position can be selected with reference to the print registration mark and will then be at the correct position in relation to the printed bag design.

The location of print registration marks is schematically indicated in Fig. 2 by short vertical bars across the strip 12A. A numeral is shown on Fig. 2 between each pair of print registration marks for reasons

which will be explained below.

Each time the sensor 34 detects a print registration mark, a signal is sent to the control device 20 (not shown) in Fig. 2. The device 20 forms a second count of the number of pulses from the shaft encoder 18 which occur between consecutive signals from the sensor 34. This count corresponds to the separation of cuts which is required to correctly form a bag. The numerals shown on Fig. 2 correspond to the counts produced as successive lengths of the strip 12A passed under the sensor 34.

The second count is used to set the pre-determined count at which the knife will operate. Each time the sensor indicates the presence of a print registration mark, the device 20 uses the second count to form a new value for a pre-determined count, which is stored. Several of these pre-determined counts can be stored simultaneously by the device 20, which uses them in the order in which they are stored to determine when the knife 14A should cut.

Thus, it can be seen from Fig. 2 that the first and second print registration marks on the strip 12A are separated by 200 counts from the shaft encoder, while the

second and third print registration marks are separated by 198 counts. Thus, the first pre-determined count will be the count required to advance the strip from the position at which the second mark is detected, to the position at which the cut position corresponding to the first mark is at the knife 14A. This count will normally be equal to the separation distance (200 counts in this case) subtracted from the distance between the sensor and the knife (1000 counts in this case). Thus, in this case, the first pre-determined count is 1000 - 200, or 800, and the first cut is made 800 counts after the second print registration mark is detected. The second pre-determined count will be 200 counts (or 200 counts greater than the first count, if the count is not zeroed at each cut). The third and fourth pre-determined counts will be 198 counts and 399 (198 counts plus 201 counts) higher than the second predetermined count, or 198 counts and 201 counts if the count is zeroed. The fifth count will be 603 counts or 204 counts. The sixth print registration mark has not yet been detected by the sensor so that the sixth pre-determined count has not yet been calculated.

The sensor 34 can be fixed in position with respect to the knife 14A and a value for the count corresponding to this separation can be permanently stored by the

device 20. During the setting up procedure, the first value of the pre-determined count is set in the following manner. The drive to the nip rollers is disconnected so that they can be turned by hand to feed strip and operate the shaft encoder 18. The strip is advanced by hand until the sensor 34 detects the first print registration mark and a command is entered through the console 32 to indicate this condition to the device 20. The device then begins counting as the strip is further advanced by hand until the sensor 34 detects the second print registration mark. At this point, a further command is entered through the console 32 to indicate the situation to the device 20. The separation of the blade and the sensor, minus the accumulated count becomes the first pre-determined count. When bag-making begins, the strip is fed until the first pre-determined count has been reached, when the knife is operated. In the meantime, other print registration marks may have passed under the sensor, in which case their separation will have been measured by the second count, and the corresponding subsequent pre-determined counts calculated.

Photo-electric sensors can sometimes be confused into erroneously detecting print registration marks when part of the printed design or specks of dirt pass under them. Accordingly, the setting up procedure can be

improved by using the separation of the first and second print registration marks as an expected value for the separation of subsequent marks. The device 20 then ignores all signals from the sensor 34 except those occurring within a relatively small range of counts centred on the expected value. The range may be approximately 10% of the expected separation. Thus, in the example shown, where print registration marks are expected to be separated by a count of about 200, the device 20 may ignore signals from the sensor 34 until a count of 180 has been achieved, but will continue to respond to signals until a count of 220 has accumulated. If a print registration mark has still not been detected, it becomes reasonable to assume that an error has occurred. Accordingly, the device 20 disables the machine.

The apparatus described above is expected to have various advantages including improved reliability and a faster and simpler method for setting up at the beginning of a run. The use of nip rollers which can run at constant speed regardless of the bag size being produced simplifies tension control of the strip which further improves the reliability of the apparatus.

CLAIMS

1. Apparatus for making bags from a continuous strip of heat sealable material, the apparatus comprising cutting means operable to cut the material, heating means operable to form a seam in the material, feed means operable to feed the material past the cutting means, transducer means operatively connected to a member which rotates as the strip passes, to provide a signal each time the rotating member reaches a pre-selected orientation, and control means operable to count the said signals and to cause the material to be cut when a pre-determined count is reached, and the apparatus further comprising a sensor for detecting print registration marks on a pre-printed strip as aforesaid, the control means being operable to perform a second count of the number of signals produced by the transducer means as the strip is advanced from a position at which a print registration mark is detected to the position at which the next succeeding print registration mark is detected, and to set the value of the pre-determined count in accordance with the second count.

2. Apparatus according to claim 1, wherein the control means may concurrently store a plurality of values of the pre-determined count for use in successive cutting operations.

3. Apparatus according to claim 1 or 2, wherein the control means is operable to store an expected value for the second count and to respond to the sensor only when the value of the second count is within a range of values which include the expected value.

4. Apparatus according to claim 3, wherein the control means is operable to stop the production of bags if no print registration mark has been detected after the second count has passed through the whole of the said range.

5. Apparatus according to claim 3 or 4, further comprising means whereby the expected value may be manually set.

6. Apparatus according to any of claims 3 to 5, further comprising means operable while the apparatus is being prepared for use, to set the expected value as the value of the second count reached between the first two occasions on which a print registration mark is detected.

7. Apparatus according to any preceding claim, wherein the drive to the feed means is disconnectable to allow the feed means to be operated by hand when the apparatus is being prepared for use.

8. Apparatus according to any preceding claim, wherein the control means determines each value of the pre-determined count by adding the second count to the pre-determined count stored immediately previously.

9. Apparatus according to any of claims 1 to 7, wherein the control means stores each value of the second count, and is operable to zero the pre-determined count at each cut.

10. Apparatus according to any preceding claim, wherein the control means is operable to set the first value for a pre-determined count as the number of signals corresponding to the separation of the sensor and the cutting means, minus the number of signals corresponding to the separation of the first two print registration marks.

11. A method for making bags from a continuous strip of heat sealable material, in which cutting means are used to cut the material, heating means are used to form a seam in the material, feed means are used to feed the material past the cutting means, the orientation of a member which rotates as the strip passes is detected and used to generate a signal at a pre-selected orientation, a count of the signals is made, and the material is cut when a pre-determined count has been reached, the method

further including sensing print registration marks on a pre-printed strip as aforesaid, conducting a count of rotations of the rotating member as the strip is advanced from a position at which a print registration mark to the postion at which the next succeeding print registration mark is detected, and setting the value of the pre-determined count in accordance with the second count.

12. A method according to claim 11, wherein a plurality of values of the pre-determined count are concurrently recorded for use in successive cutting operations.

13. A method according to claim 11 or 12, wherein an expected value for the second count is recorded and no response is made to the output of the sensor except when the value of the second count is within a set range of values which include the expected value.

14. A method according to claim 13, wherein the production of bags is stopped if no print registration mark has been detected after the second count has passed through the whole of the said range.

15. A method according to claim 13 or 14, wherein the expected value is manually set.

16. A method according to claim 13, 14 or 15, wherein,

when the apparatus is being prepared for use, the expected value is preferably set as the value of the second count reached between the first two occasions on which a print registration mark is detected.

17. A method according to any of claims 11 to 16, wherein the drive to the feed means is disconnected when the apparatus is being prepared for use, and the rollers are turned under manual control.

18. A method according to any of claims 11 to 17, wherein each value of the pre-determined count is determined by adding the second count to the pre-determined count stored immediately previously.

19. A method according to any of claims 11 to 17, wherein each value of the second count is stored, the pre-determined count being zeroed at each cut.

20. A method according top any of claims 11 to 19, wherein the first value of the pre-determined count is set as the count corresponding to the separation of the sensor and the knife, minus the count corresponding to the separation of the first two print registration marks.

21. Apparatus substantially as described above with

reference to the accompanying drawings.

22. A method substantially as described above with reference to the accompanying drawings.

23. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not within the scope of or relating to the same invention as any of the preceding claims.

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